

Gum induction from arid tree species

an alternative source of income

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In arid ecosystem, trees play prominent role in sustainable income generation to the rural population. Gum collection through potential gum-yielding tree species i.e. well known gum producing trees and lesser-known gum producing trees can create an additional income generation opportunity to the farmers in the lean period without heavy investment. CAZRI has developed technology to enhance existing gum production potential especially gum arabic, one of the edible gum having huge demand and widely used, but with low production through traditional methods. CAZRI technologies were well adopted by the farmers of the region and they were collecting an average 450 g gum/arabic tree in lieu of 15 to 25 g tree⁻¹ through conventional method and the sustainable harvest of gums resulted in employment generation and emerged as an alternative source of income to the farmers of arid region.

Key words: *Acacia senegal*, Agroforestry, Arid region, Gum arabic, Gum production

IN India, arid regions mainly spread over the Rajasthan, Gujarat, Punjab, Haryana, and is known as Thar desert. Due to the lack of most of the resources in this region, farmers always practice diversified farming by incorporating trees and livestock in addition to growing agricultural crops to sustain their livelihood. Agroforestry became a traditional practice in these areas due to the frequent drought and crop failure. Trees and perennial vegetation resources gave a long-term alternative source of livelihood strategy to rural farmers besides crop farming. Most of trees of the region are multipurpose and farmers keep them in their fields as well as in boundaries. Along with timber, it provide them fodder, fuel, food etc. Farmers also collect natural gums and resins from the perennials, which are directly related to livelihood of rural folk in the region. *Acacia senegal*, a tree widely distributed in western arid Rajasthan, is known for the production of edible gum tree known as Gum Arabic, and has a wide

domestic and industrial uses. Gum arabic is obtained, as a dried exudate from stems and branches. Due to its wide usage in the domestic and industries, local production of Gum arabic is not able to meet the requirement. India is importing an average 29,010 tonne of gum arabic/year having a value of ₹ 12,043 lakh, reflected the huge demand of the commodity. Traditionally, farmers collect gum from trees by making small incisions in tree trunk during summer. Even after having this

laborious and deleterious work, the production of gum is very low (15 to 25 g tree⁻¹). The high demand of gum arabic in the local market, give farmers an alternate source of income during the lean period. There are number of other tree species besides *A. senegal*, which yields natural resins and gums in hot arid region. Central Arid Zone Research Institute (CAZRI), Jodhpur identified other edible gum producing tree species in hot arid region which includes *Acacia jacquemontii*, *A. tortilis*, *A. nilotica*,

Table 1. Tree structural traits and gum yield of different trees species.

Category of gum trees	Trees species	Average tree height (cm)	Average GBH (cm)	Average canopy diameter (cm)	Average gum yield (g/ tree)
Known gum-yielding species of the region	<i>Acacia senegal</i>	565.0	39.6	375.00	435.0
	<i>Acacia tortilis</i>	434.0	45.60	278	265.00
	<i>Acacia nilotica</i>	385.00	38.62	195	178.15
	<i>Prosopis cineraria</i>	496.00	75.67	350.00	120.00
	<i>Anogeissus rotundifolia</i>	655.00	90.50	515.00	210.0
Lesser known gum-yielding species of the region	<i>Prosopis juliflora</i>	315.0	22.00	255	181.25
	<i>Balanites aegyptiaca</i>	416	39.40	216	196.6
	<i>Acacia leucophloea</i>	710.00	52.22	510.00	130.89
	<i>Cordia myxa</i>	650	65.67	510	156.5
	<i>Cordia gharaf</i>	245	56.6	324	166.7

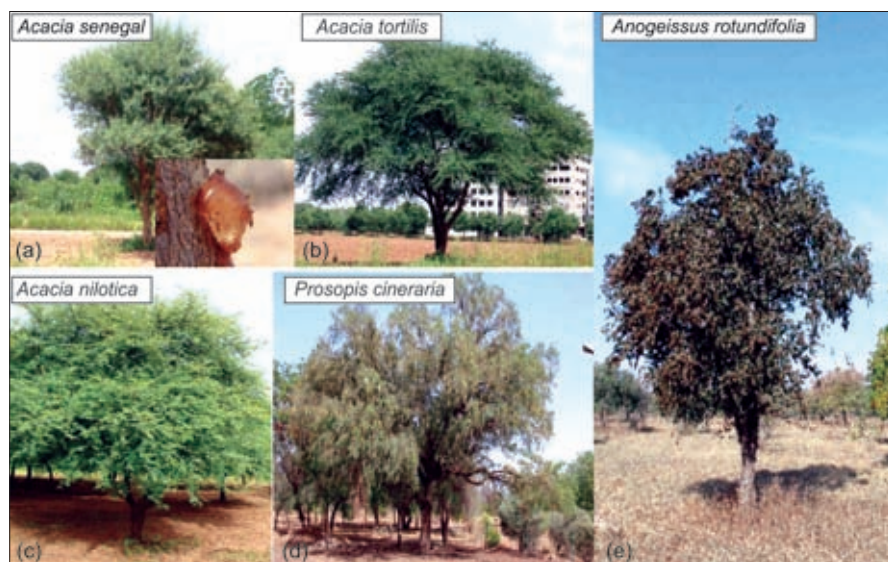


Fig. 1. Gum production from well known trees.

Anogeissus pendula, *A. rotundifolia*, and *Prosopis cineraria* (Table 1). Also CAZRI, Jodhpur developed a technology for the sustainable and enhanced gum production, which is highly benefited to the farmers and the technology is widely spreading in the arid farmer communities.

Major gum producing tree species

Acacia senegal

Acacia senegal is the major source of gum arabic. The species was well naturalized in Indian sub-continent and prominently found in arid western Rajasthan and it forms important component of traditional agroforestry system. It showed wide distribution in different land forms like rocky hills, sandy plains, sandy hummocks and sand dunes. *Acacia senegal* has multipurpose uses along with the Gum arabic production. Gum arabic exudes from the duct of the inner bark; naturally it is exuded in the hot season (May-June) when the trees are in the stressed condition. The CAZRI gum inducing technology enhanced the yield of gum arabic to the tune of 200 g to 2,500 g tree⁻¹. The gum obtained from *Acacia senegal* (Fig. 1a) is widely used in domestic purpose and it fetches a domestic market cost of ₹ 1,000.00/kg. It is one of the major ingredients in the *gond ladoo* which is one of the healthy sweets given to pregnant women traditionally as it rich in calcium and protein. It is also

given to lactating mothers to increase the production of breast milk. It helps one to develop strong bones and prevent back pain. Gum is considered a warming food and is best taken during winters; it is especially useful for people living in temperate places. It improves immunity and if had during winter will prevent from cold and cough.

Acacia tortilis

Acacia tortilis, locally known as Israeli babool is also an exotic tree species, introduced and naturalized in Indian arid regions. Gum quality is almost similar to gum arabic and known as 'poor man gum'. It can be good source of gum, if properly exploited. *A. tortilis* (Fig. 1b) is drought resistant, can tolerate strong salinity and seasonal water-logging and generally forms open, dry forests in pure stands or mixed with other species. The experiments with CAZRI gum inducer has yielded 100 to 900 g gum tree⁻¹. Gum obtained from *Acacia tortilis* also used as a food additive and for medicinal purpose.

Acacia nilotica

Acacia nilotica (Fig. 1c) is a popular farm tree of the central plains of India and is a source of Indian gum arabic. *Acacia nilotica* subsp. *cupressiformis* makes an ideal windbreak to surround fields as its narrow crown shades less than other windbreak species. The pods are

desirable as fodder for cattle, and the leaves, young shoots and young pods are considered to aid milk production. Gum is present in the bark and tends to be dark. These species may indeed were the original source of true gum arabic which is now obtained commercially from *Acacia senegal* (Fig. 1a). The CAZRI experiments on gum production potential recorded 100 to 400 g gum tree⁻¹. The *Acacia nilotica* (Fig. 1c) gum, samogh or *samuk* (Arabic) is sold in balls and is of commercially inferior quality. It was used as an emulsifying agent and emollient. It is edible and was used to relieve throat and chest complaints.

Prosopis cineraria

Prosopis cineraria (Fig. 1d), commonly known as *khejri*, is a leguminous multipurpose tree. The wood of *P. cineraria* is a good fuel source, and provided excellent charcoal plus firewood, fodder, green manure and goat-proof thorny fences. The leaves, called *Loong* in India and pods are consumed by livestock and are beneficial forage. *P. cineraria* plant produces gum, which is obtained between May and June.

This tree showed gum production to the tune of 100 to 300 g tree⁻¹ in the experiments conducted at CAZRI. *Prosopis cineraria* (Fig. 1d) exuded gum, pale to amber coloured with properties similar to the gum acacias. Gum is used as folk remedy for various ailments. Rural folk use it to make sweet dish and as well as Ayurveda medicine particularly in Rajasthan.

Anogeissus sp.

The main value of the tree (*Anogeissus rotundifolia* Fig. 1e) lies in its afforestation purposes on the semi- rocky and rocky terrains of arid regions. The tree bark is the source of Indian gum, also known as *ghatti*. This species showed potential of producing 300 to 1,800 g gum/tree and the gum is mainly used for making *laddu*, which was considered to have medicinal properties. The rural people used it to get rid of back pain after delivery and to cure damaged tissue. It was also used for calico printing.

Lesser-known gum producing tree species

There are a large number of trees in India, which exude gums and resins. Some of these are of local or limited interest.

Prosopis juliflora

Prosopis juliflora is commonly known as *vilayati babul* in the arid region. It is widely spread over the all ecological conditions. The gum production and its utilization are not much known by the people so it is an underutilized resource. The exudate gum from *P. juliflora* appears as a viscous liquid exuding from the trunk or branches of the tree, before drying and becoming solid. The colour can vary from translucent to yellowish, generally amber, becoming darker with age. *Prosopis* sp. gums are soluble in water with a low viscosity. They are odourless and have little taste, are non-crystalline and non-soluble in alcohol or ether. *P. juliflora* yielded an average of 100 to 500 g tree⁻¹. The gum forms adhesive mucilage, used as an emulsifying agent. Gum can be used in confectionary and for mending pottery.

Balanites aegyptiaca

Balanites aegyptiaca, commonly known as *Hingota*, produces a greenish-yellow to orange-red resin from the stems. It is sucked and chewed when fresh. It is used as a glue for sticking feathers onto arrow shafts and spearheads and in the repair of handle cracks and arrows. The natural gums from the branches are used as glue, and the seeds were used to make jewellery and beads. The experiments done by CAZRI gum inducer showed an average gum yield of 100 to 400 g tree⁻¹.

Acacia leucophloea

Acacia leucophloea commonly called as safed *kikkar* and it is a large thorny tree attaining a height of 35 m and a dia of 100 cm at breast height. The tree is having various medicinal properties. People are using bark extracts in traditional medicine as an astringent, a bitter, a thermogenic, a styptic, a preventive of infections, an anthelmintic, a vulnerary, a demulcent, an expectorant,

an antipyretic, an antidote for snake bites and in the treatment of bronchitis, cough, vomiting, wounds, ulcers, diarrhoea, dysentery, internal and external haemorrhages, dental caries, stomatitis, and intermittent fevers and skin diseases. The experiments with CAZRI gum inducer showed an average yield of 50 to 300 g gum tree⁻¹. The gum obtained from the stem is also used medicinally. It is the source of a low quality gum that is used to adulterate gums of higher quality. A water-soluble gum of fair quality can be extracted from the stem and root bark.

Cordia species

Cordia is a genus in the family Boraginaceae in the major group of Angiosperms. Commonly called as *Gundi* and *Gunda*, *Lasoda*, *lasudi*, *Lasura*, *Assyrian* plum the plant possesses good medicinal value and is used by the people for the treatment of various diseases. A clear gum obtained from the bark is eaten. A gum obtained from the bark is used to adulterate gum Arabic by the people. The CAZRI-gum inducer when treated in *Cordia* species yielded 50 to 300 g tree⁻¹.

INNOVATIONS

Gum arabic is a commodity which has wide use in the daily life of village communities. The huge demand in the domestic market has resulted in the crude method of extracting the gum from the available trees.

In traditional method of gum tapping in different parts of the world, a number of tapping spots on tree trunks and branches depending on its size are made and in the process plants get injured at various points and produce only less amounts of gum. It increased the mortality of the gum producing trees in the arid region.

CAZRI gum arabic inducing technology and its sustainability

The CAZRI is having mandate of improving the livelihood of arid region and took initiatives to answer the problems of farmers regarding gum production. In earlier nineties CAZRI identified the potential

market and in search of sustainable technology for the gum production, experiments were started. The experiments involved testing various chemicals in different concentration and treated tree in different seasons to understand the gum production potential. In late 2000, CAZRI identified a chemical concentration and procedure for the application, which enhanced the gum production without mortality to the trees. The techniques developed by Central Arid Zone Research Institute, Jodhpur (Rajasthan), showed advantage over the traditional method as the plant is injured only at one place on tree trunk to inject CAZRI gum inducer (Fig. 2A-E) and in turn it produces on an average 400 to 500 g gum arabic tree⁻¹ season⁻¹.

Extraction of gum and resin: an alternative source of livelihood for farmers: Tree gum collection is a source of livelihood to the farmers in the arid region. The gum arabic, which is widely collected in western Rajasthan and used in local households to make *laddos* as it is known to have vast medicinal properties. Therefore, its demand is huge in local markets and its rate is ₹ 1,000/kg. Gum arabic has extensive application in food industries. It is included in food formulations ranging from ice creams, jellies, candies, soft drinks, beverages, syrups, and chewing gums owing to its emulsifying, stabilizing, thickening and binding properties. The film-forming properties make it ideal for confectionery coatings and glazes. Besides Gum arabic is also utilized in printing and textile industries. The wide usage of Gum arabic in various industries increases the demand of quality gum production which in turn provides alternative source of livelihood to farmers. The western Rajasthan is mostly hit by drought which are always accompanied by the risk of crop failure and in these conditions farmers need some other alternatives to earn their livelihood; and hence gum and resin extraction from potential species can provide the alternative means of income generation. The price of gum arabic and gum from *A. jacquemontii* at present sold in local town markets

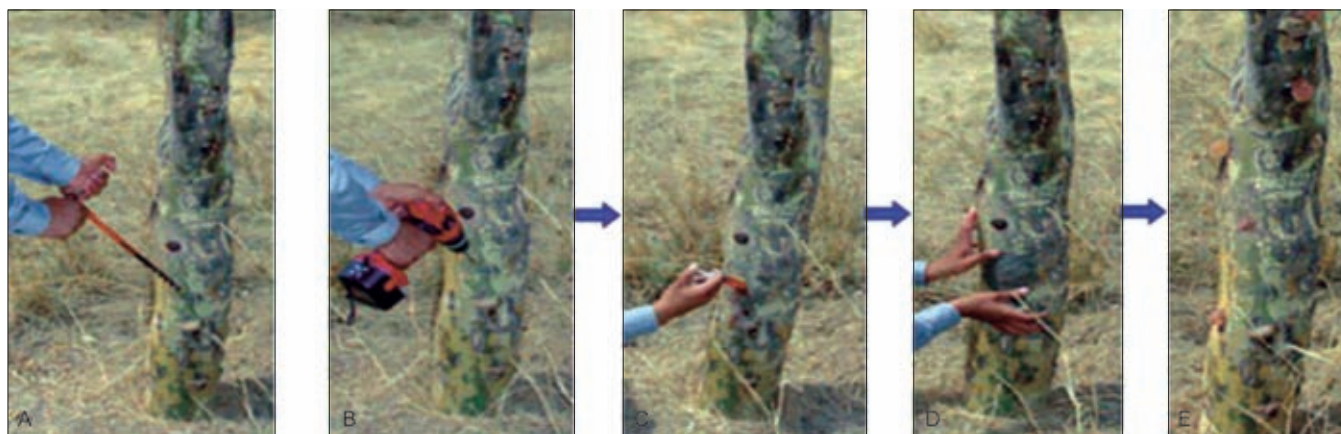


Fig. 2. A. Making hole with hand drill

B. Making hole with battery operated drill

C. Injecting CAZRI Gum inducer solution

D. Covering the hole by moistened clay

E. Exudaed gum tears

₹ 1,000 kg⁻¹ and for other species it is ₹ 400 to 500 kg⁻¹. Besides, extraction and sale of oleoresin produced from *Boswellia serrata* and *Commiphora wightii* having high medicinal values can provide good return to farmers. Farmers on an average earned additional income of ₹ 1.23 lakh/villages/year by the sale of gum arabic as their non-tember tree product.

In parts of district Barmer, Nagaur, Jodhpur and Jaisalmer, and they are now producing gum arabic just like gum gardens of Sudan and Nigeria. There is need for proliferation of scientific gum tapping from *A. senegal* and other gum and resin yielding species as well. Though, large numbers of farmers from Barmer, Jaisalmer, Jodhpur districts are approaching CAZRI for adoption of gum induction technology but there is scope to expand technology and the efforts are on so that maximum number of farmers can be benefited from this technology. The technology has potential to change the scenario of income and service provided by gum yielding trees in arid land farming systems. However, there is urgent need to employ the technology in sustainable manner so that there is no harm to the tree for long-term production.

Tree resources supply an alternative source of livelihood to farmers along with practising agriculture. The natural products from wild are used by numerous people around the world and its

popularity is increasing day-by-day in all fields. The use of natural gums and resins is expanding in pharmaceutical, food, confectionery and other industries.

The oldest and best known tree gum is gum arabic obtained from *Acacia senegal*. *Acacia leucophloea*, *Balanites aegyptiaca*, *Cordia* spp., *Prosopis cineraria*, and *Prosopis juliflora* are other locally available lesser known gum producing trees used as source of various medicines by local communities. The technology, developed by CAZRI for gum induction, significantly improved gum yield in the above species which were not used for gum extraction traditionally. The standardization of gum inducing and exploring new lesser known gum tree species will create alternate employment and income generation opportunities for farmers.

CAZRI gum arabic inducing technology

The technique, developed by Central Arid Zone Research Institute, Jodhpur, showed an enhanced production (400 to 500 g gum arabic tree⁻¹season⁻¹) from the traditional method (15 to 25 g gum arabic tree⁻¹ season⁻¹).

Procedure

A 45° slanted 3 cm deep hole of 18 mm dia is made on tree trunk at 1 to 2 feet (30 to 60 cm) above the collar of the tree with the help of hand drill or battery operated drill machine. After that, 4.0 ml of CAZRI gum-inducer is injected in

the hole with the help of syringe. After injecting the dose of Gum inducer the hole is immediately covered (patched up) by moistened clay.

The tree started exuding gum tears after 8 to 10 days of the treatment.

Some important points

- One should avoid treating the tree, if weather is humid, cloudy or rain is expected.
- The best season to treat the tree started from after leaf fall (mid-March) to before leaf initiation (last week of May).
- The best results were found in trees of more than 10-year- old growing in sandy soils, sand dune and inter-dune areas.
- It is ensured that while covering the hole the clay should not enter into the hole, otherwise it would lead to outward absorption of the chemical. While patching up (covering), press the clay from sides on periphery of the hole.
- Gum tears are exuded from different portions of stem and branches from base to top.

SUMMARY

For collection of gum tears first allow them to dry on the tree itself for 5 to 7 days, once tears are semi-solid they can be removed by hand from lower parts of the tree.

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